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(54) Data compressing subscriber identity module

(57) A Subscriber Identity Module SIM 34 - being a smart card comprising a microprocessor 36 and memory 38 - for a mobile station 8 used in a GSM mobile communications system, has the SIM operating system adapted to perform data coding format conversion for data items stored in the SIM and transmitted to the mobile station. This ensures that the SIM is able to receive, and present, data items in the required standard format at the interface between the mobile station and the SIM, whilst allowing the data items to be stored in a compressed format in the SIM memory, thereby increasing the perceived storage capacity of the SIM. In the case of abbreviated dialling number ADN records, data compression may be achieved by removing padding data from a fixed length data coding format so as to store data in a compressed coding format having variable length data fields. Other data, e.g. MDN and MSISDN, may also be stored and compressed by different methods and a gradual de-fragmentation procedure is also discussed.

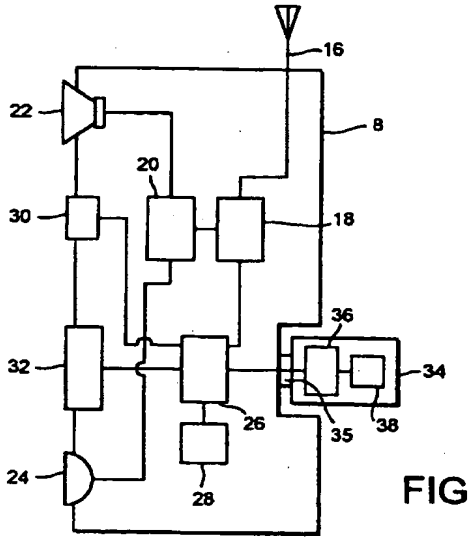

FIG. 2

GB 2 317 246 A

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

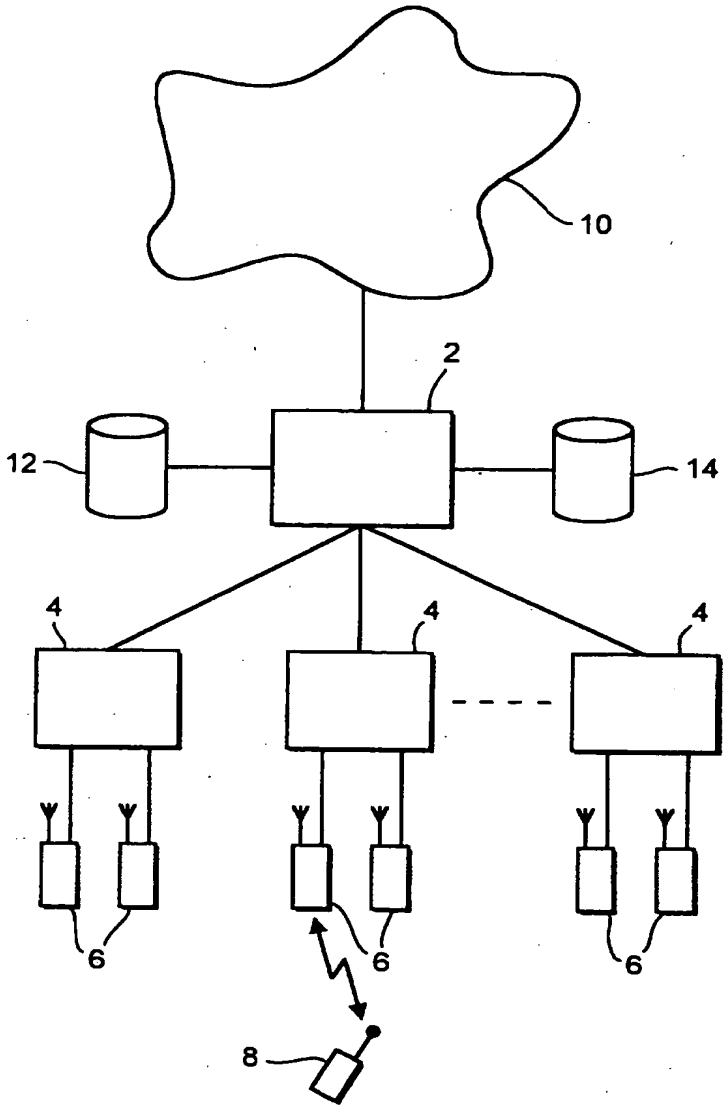

FIG. 1

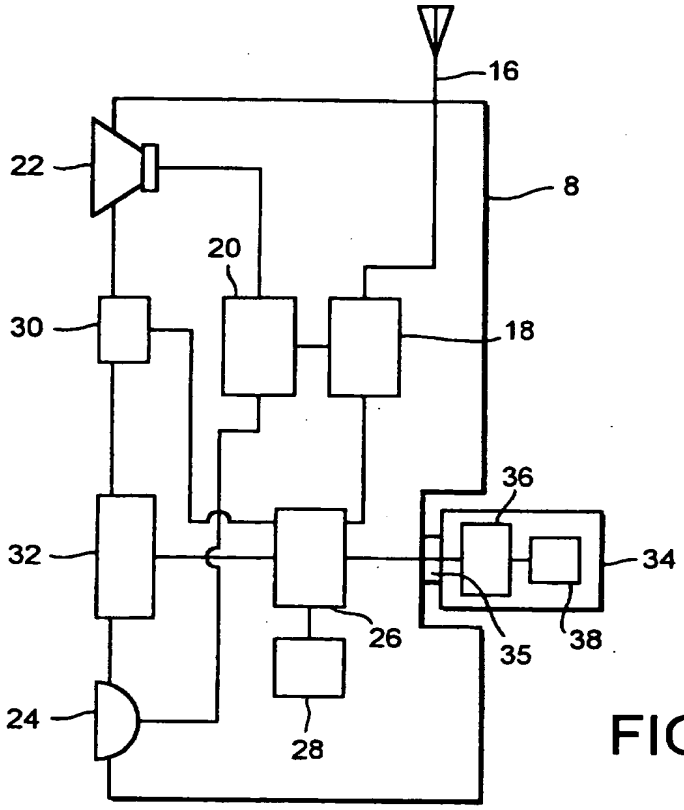
16
22
8
20
30
18
36
32
34
26
35
38
24
28

FIG. 2

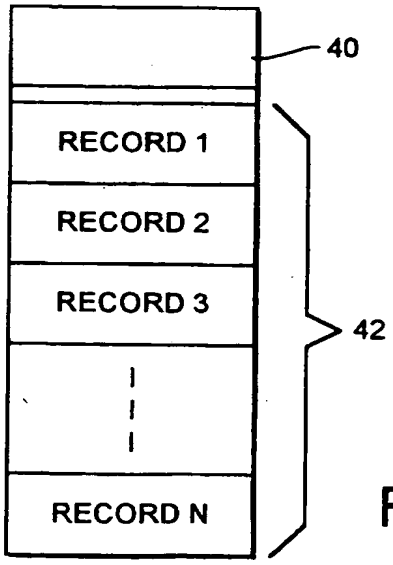
40
RECORD 1
RECORD 2
RECORD 3
RECORD N
42

FIG. 3

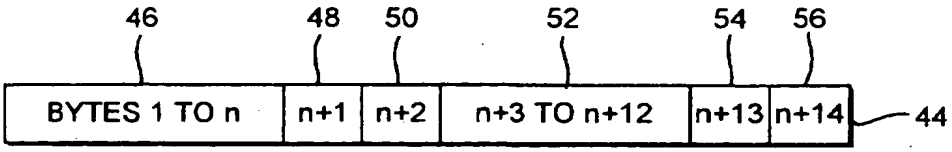

FIG. 4

TYPICAL DIALLING NUMBERS:	CODED AS:
HOME	49 4F 4D 45 FF FF FF FF FF FF FF FF 07 81 10 32
01234 567890	54 76 98 F0 FF FF FF FF FF FF
OFFICE	4F 46 46 49 43 45 FF FF FF FF FF FF 07 81 10 32
01234 987650	94 78 65 F0 FF FF FF FF FF FF
FRED MOBILE	46 52 45 44 20 4D 4F 42 49 4C 45 FF 06 81 90 37
0973 123456	21 43 65 FF FF FF FF FF FF FF

FIG. 5

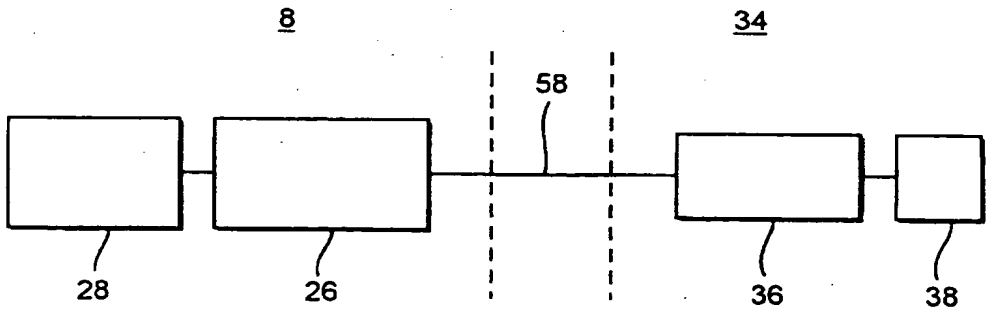

FIG. 6

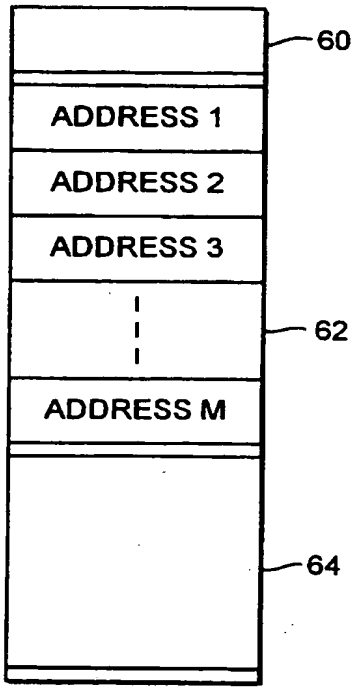

FIG. 7

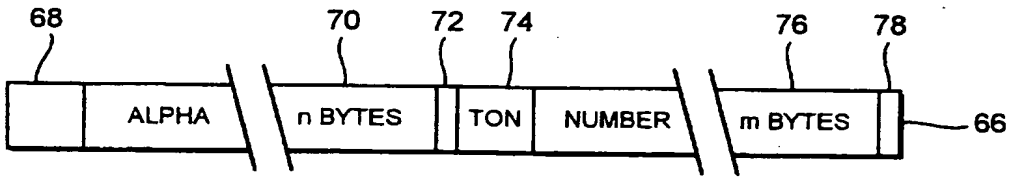

FIG. 8

TYPICAL DIALLING NUMBERS:	CODED AS:
HOME 01234 567890	XY 49 4F 4D 45 F 81 10 32 54 76 98 0 F
OFFICE 01234 987650	WZ 4F 46 46 49 43 45 F 81 10 32 94 78 65 0 F
FRED MOBILE 0973 123456	UW 46 52 45 44 20 4D 4F 42 49 4C 45 F 81 90 37 21 43 65 F

FIG. 9

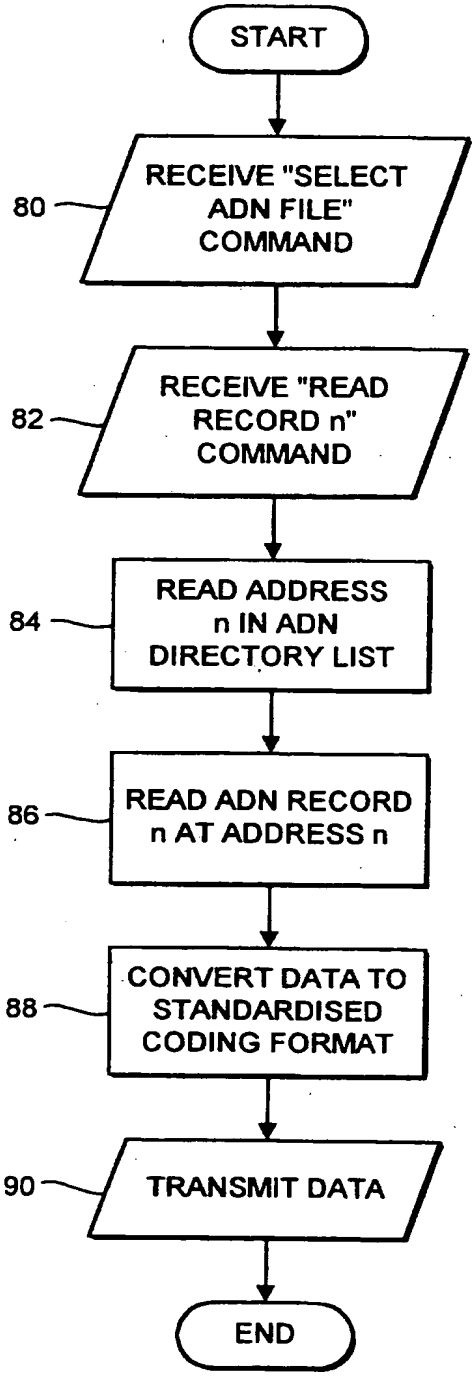
START
80
RECEIVE "SELECT ADN FILE" COMMAND
82
RECEIVE "READ RECORD n" COMMAND
84
READ ADDRESS n IN ADN DIRECTORY LIST
86
READ ADN RECORD n AT ADDRESS n
88
CONVERT DATA TO STANDARDISED CODING FORMAT
90
TRANSMIT DATA
END

FIG. 10

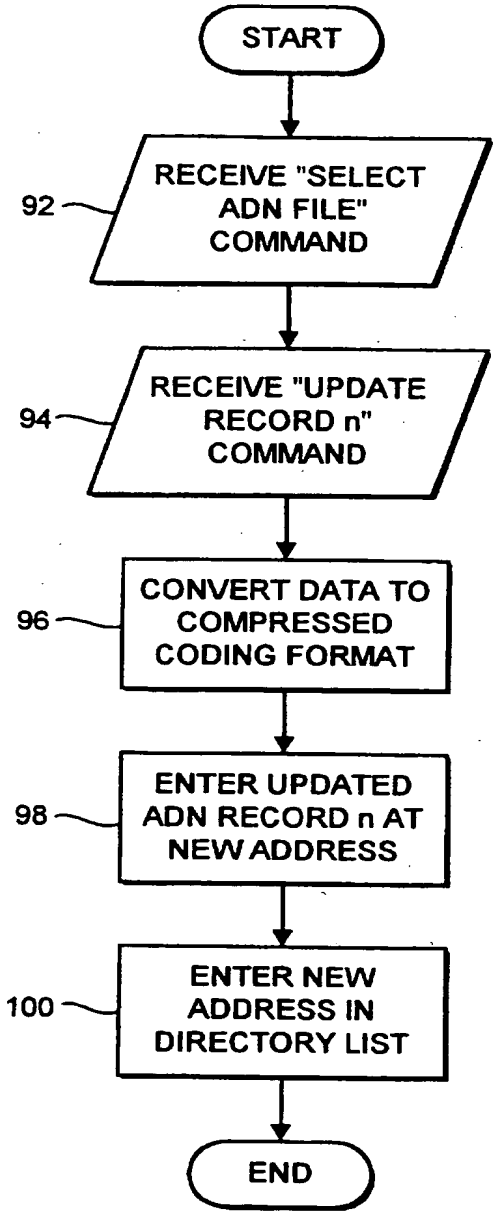
START
92
RECEIVE "SELECT ADN FILE" COMMAND
94
RECEIVE "UPDATE RECORD n" COMMAND
96
CONVERT DATA TO COMPRESSED CODING FORMAT
98
ENTER UPDATED ADN RECORD n AT NEW ADDRESS
100
ENTER NEW ADDRESS IN DIRECTORY LIST
END

FIG. 11

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DATA STORE

This invention relates to a removable data store, in particular but not exclusively, for a user station used in a mobile communications system, such as a subscriber identity module (SIM) as used in a GSM (Global System for Mobile communications) digital cellular radio system, to a user station including such a data store, and to methods of transmitting data items to and from such a data store.

In a known conventional GSM system, each mobile station, such as a mobile telephone handset, is provided with a SIM, herein also referred to as a smart card, which is inserted into the mobile station in order to allow the mobile station to receive service in a GSM network.

A typical SIM includes a microprocessor, memory elements including a permanent memory (e.g. ROM), a non-volatile rewritable memory (e.g. EEPROM) and a volatile rewritable memory (e.g. RAM), and contacts for forming the data transfer interface between the SIM and the mobile station.

The GSM standard also specifies a command set for use by a mobile station to access data records in the SIM and retrieve and write data from and to the SIM.

Such data records may be permanent data records, such as a record of the international mobile subscriber identity (IMSI) whereby the mobile subscriber is recognised by a mobile communications network.

Other data records are modifiable, either at the initiative of the mobile station (such as the data record holding the current location area information (LAI) for the mobile station) or at the initiative of the mobile subscriber (such as an abbreviated dialling number (ADN) record which is used to allow the subscriber to automatically initiate calling of the stored dialling number by selection of the associated dialling number identifier when displayed by the mobile station).

Other modifiable data records include a short message data record, which stores data relating to one or more short messages in alphanumeric characters received by the mobile station, for future retrieval by the subscriber.

For more details of the records which may be stored in a SIM, reference should be made to GSM Technical Specification 11.11 (ETS 300 608).

The memory capacity of the SIM is necessarily limited, primarily due to cost considerations. Accordingly, the data records referred to above are limited in size and number in accordance with the

memory capacity of the SIM, which can be a drawback. For example, in the case of ADN records, it is conventional to allocate sufficient memory capacity dedicated to an ADN list such that up to 90 ADN records can be provided. Some subscribers however require a greater ADN storage capacity. This is evidenced by the fact that ADN storage capacity is used as a positive marketing point by suppliers who are able to provide SIM's having relatively large ADN storage capacities. However, with a fixed amount of total memory capacity available, an increase in the memory capacity allocated to ADN records must be compensated for by a reduction in the memory capacity allocated to other data records.

Accordingly, the present invention in one aspect provides a removable data store for a user station used in a mobile communications system, said store comprising a memory for storing data items communicated via an interface between said store and said user station, the data items having a standardised data coding format when communicated via said interface and said data items may be stored in said memory in a different data coding format.

Thus, even if a standardised data coding format for a data item transmitted via the data store/user station interface is not considered to be the most

appropriate, by use of the present invention the data item can still be stored in the data store in a desired data coding format, without rendering the data store incompatible with the chosen standard.

The data coding format conversion is preferably implemented invisibly to the user station. That is to say, the communication of data items via the interface between the data store and the user station can be implemented in the data coding format required by the chosen standard, irrespective of the data coding format used for stored items.

Thus, the data store can remain compatible with all user stations complying with the chosen standard. In this respect, the data store preferably comprises data coding format converting means operating between said interface and said memory.

In some cases, data items are required to conform to a standardised fixed length data coding format when communicated to or from the user station. The data coding format converting means then preferably converts data items from said fixed length data coding format to a variable length data coding format. More efficient data coding can thereby be achieved. For example, in the case of ADN records, the use of a variable length coding format for storage of ADN data items can increase the amount of ADN records

available, compared to the conventional storage format, by over 50%. Thus, the number of ADN records available can be increased to over 100, without increasing the memory allocated to the ADN list.

The data items may comprise a variable quantity of non-padding character data (i.e. data relating to useful information), and when in the standardised data coding format a variable quantity of padding data (i.e. data of which the contents are ignored). The data coding format converting means is preferably operable to reduce the amount of padding data when converting the data items to the different data coding format. Data items can then be stored in a more compact coding format in a given allocation of memory capacity.

The present invention in another aspect provides a smart card comprising a memory for storing data items, input/output means for communicating said data items to and/or from an external device in one data coding format, and data coding format converting means connected between said memory and said input/output means, operable such that said data items may be stored in said memory in a different data coding format. Thus, the present invention may be applied in relation to smart cards in general in order to store data items in the smart card in a desired data coding

format which is different to that used when the smart card is externally accessed.

The invention in a further aspect provides a smart card comprising a memory for storing data items, input/output means for communicating said items to and/or from an external device in one data coding format, and data coding format converting means connected between said memory and said input/output means, operable such that said data items may be stored in said memory in a different data coding format.

In a still further aspect, the invention provides a method of writing a data item to a data store for a user station used in a mobile communications system, comprising transmitting said data item to said data store in one data coding format, converting said data item to a second different data coding format, and storing said data item in said data store in said second data coding format.

The invention in a yet further aspect provides a method of transmitting a data item from a data store for a user station used in a mobile communications system, comprising converting the data item to a different coding format from that in which it is stored, and transmitting the converted data item to said mobile station.

Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a block diagram of a mobile communications network;

Figure 2 is a block diagram of a mobile station;

Figure 3 illustrates the structure of a linear fixed data file;

Figure 4 illustrates the structure of a fixed length data record;

Figure 5 illustrates a standard coding of typical dialling numbers;

Figure 6 illustrates a principal of the present invention;

Figure 7 illustrates the structure of a data file according to the present invention;

Figure 8 illustrates the structure of data record according to the present invention;

Figure 9 illustrates the coding of typical dialling numbers according to the present invention;

Figure 10 is a flow diagram showing a procedure followed by the SIM of a mobile station when reading an ADN record in accordance with the present invention; and

Figure 11 is a flow diagram showing a procedure followed by the SIM of a mobile station when updating

an ADN record in accordance with the present invention.

A GSM network, referred to as a public land mobile network (PLMN), is schematically illustrated in Figure 1. This is in itself known and will not be described in detail. A mobile switching centre (MSC) 2 is connected via communication links to a number of base station controller (BSCs) 4. The BSCs 4 are dispersed geographically across areas served by the mobile switching centre 2. Each BSC 4 controls one or more base transceiver stations (BTSs) 6 located remote from, and connected by further communication links to, the BSC. Each BTS 6 transmits radio signals to, and receives radio signals from, mobile stations 8 which are in an area served by that BTS. That area is referred to as a "cell". A GSM network is provided with a large number of such cells, which are ideally contiguous to provide continuous coverage over the whole network territory.

A mobile switching centre 2 is also connected via communications links to other mobile switching centres in the remainder of the mobile communications network 10, and to other networks such as a public service telephone network (PSTN), which is not illustrated. The mobile switching centre 2 is provided with a home location register (HLR) 12 which is a database storing

subscriber authentication data including the international mobile subscriber identity (IMSI) which is unique to each mobile station 8. The IMSI is also stored in the mobile station in a subscriber identity module (SIM) along with other subscriber-specific information.

The mobile switching centre is also provided with a visitor location register (VLR) 14 which is a database temporarily storing subscriber authentication data for mobile stations active in its area.

Referring to Figure 2, a mobile station 8 comprises a transmit/receive aerial 16, a radio frequency transceiver 18, a speech coder/decoder 20 connected to a loudspeaker 22 and a microphone 24, a processor circuit 26 and its associated memory 28, an LCD display 30 and a manual input port (keypad) 32. The mobile station is connected to a removable SIM 34 via electrical contacts 35.

The SIM 34 connected to the mobile station has a SIM processor 36, for example a Hitachi H8 microprocessor, and SIM memory 38, which includes for example 16 kilobytes of mask-programmed ROM 38a containing the SIM operating system, 8 kilobytes of read/write EEPROM 38b for the non-volative storage of data items and 256 bytes of RAM for use by the SIM processor 36 during operations.

At present, two physical formats of SIM are specified by the GSM and ISO standards. The first is referred to as an ID-1 SIM, which is a removable smart card complying with the ISO 7816 standard and being of similar dimensions to that of a conventional credit card. The second is referred to as a plug-in SIM, which is a smart card of the same thickness as the ID-1 SIM, but only measuring 25 millimetres in length and 15 millimetres in width.

Both the mobile station 8 and the different formats of SIM 34 are well known and therefore need not be described in detail herein. A commercially-available SIM is the GemXplore (registered trade mark) SIM card produced by Gemplus, BP 100-13881, Gemenos Cedex-France.

As described above, the SIM 34 is used for the storage and retrieval of data items by the processor 26 of the mobile station 8. The command set, data file structure and data coding format for data communicated via the interface between the mobile station processor 26 and the SIM processor 36 are all specified, in the GSM system, in GSM technical specification 11.11.

A standard GSM file structure for the storage of data on a SIM, referred to as a linear fixed file structure, is illustrated in Fig. 3. It consists of

a header 40 and record space 42. The record space is divided into N fixed length records.

One example of data record provided in the SIM memory 38 in a conventional SIM 34 is an abbreviated dialling number (ADN) record 44, which forms part of an ADN list file having a linear fixed file structure. Each ADN record 44 has data stored in a fixed length coding format. The record 44 is divided into fixed-length data blocks, each consisting of one or more bytes. A first data block 46, consisting of n bytes, is reserved for data relating to a dialling number identifier, such as a person's name, or a company name. A second block 48, consisting of one byte, is reserved for data indicating the length of the dialling number. A third block 50, consisting of one byte, is reserved for data indicating the type of dialling number stored in the record. A fourth block 52, consisting of 8 bytes of memory, is reserved for the dialling number data itself, coded in extended BCD coding as defined in GSM Technical Specification 11.11. A fifth block 54, consisting of one byte, is reserved for a "capability configuration pointer", indicating the bearer services (e.g. voice call, fax, etc.) which can be supported by the telephone equipment corresponding to the dialling number stored. A final data block 56, consisting of one byte, is an

extension record pointer, which indicates the address of an extension record to be accessed in a different data file to give the remainder of a dialling number. The extension record pointer is used only in the rare case that the dialling number is longer than can be stored in the allocated data block 52.

Referring to Figure 5, data items relating to three typical dialling numbers and their associated dialling number identifier are shown coded in the standardised format. Each nibble (four bits of data) is indicated in hexadecimal notation. It will be seen that the coded data consists not only of useful character data, but also of padding data (in this case hexadecimal "F"s) which is added to fill unused memory space in the fixed-length record. Thus, for the dialling number identifier "home", 4 bytes are used for coding the character data, whereas in this case 10 bytes are available. The remaining 8 bytes are filled with padding data. The length of number indicator ("07") is coded in one byte, and the type of number code ("81") is coded in the next byte. The dialling number itself is stored in a nibble-swapped coding format, that is to say that, in each byte, the nibbles are coded in reverse order. The character data corresponding to the dialling number "01234 567890", occupies 5½ bytes, and 4½ bytes of the data block 52

are filled with padding data. As is generally the case, no extension record data or capability configuration pointer data is available. The last two data blocks 54 and 56 are therefore also filled with padding data.

The principle of this embodiment of the present invention is illustrated in Figure 6. In accordance with this embodiment of the invention, a standardised data coding format need only be used selectively in communications between the mobile station 8 and the SIM 34. Data is transmitted between the SIM processor 36 and the SIM memory 38 in a different data coding format to that used across the communications interface 58 between the SIM processor 36 and the mobile station processor 26.

In the case of the present embodiment, the operating system stored in the ROM of the SIM processor 36 is adapted to compress and decompress data communicated between the SIM memory 38 and the interface 58. That is to say, the data coding format used in records provided in the SIM memory 38 is not the same as that used when those data records are communicated across the interface 58 to and from the mobile station processor 26.

This allows a more compact data coding format to be implemented in the SIM memory 38, whilst the SIM

itself conforms with a prescribed GSM standard.

Referring now to Figure 7, a new file structure is provided for variable-length data records in the SIM. This file structure includes a header portion 60, a directory list 62 and record space 64. The header 60 consists of 2 bytes of data, the first indicating the average length of records in the record space 64 and the second indicating the number of valid records in that space. The directory list 62 is divided into N blocks which provide storage space for addresses, or offset address values, for up to N data records in record space 64. The record space 64 contains the variable length ADN data records.

A data coding format for an ADN data item when stored in record space 64 is shown in Figure 8. The ADN record 66 consists of various data blocks. A first fixed length data block 68, consisting of one byte, has individual bits allocated for various information. One bit is reserved for an extension record flag, a second is reserved for a capability configuration flag, a third bit is available for storage of other information, and five bits are allocated for indicating the byte length of the record. A second, variable length, data block 70 consists of n bytes, containing the dialling number identifier data. Each of these bytes is filled with

non-padding character data, for example the name of the party to be called, coded in the 7-bit coded alphabet as defined in GSM Technical Specification 03.38, with the eighth bit of each byte set to zero. The length of the data block 70 corresponds with the length of the dialling number identifier.

A third data block 72 consists of one nibble with each of its bits set to "one", i.e. hexadecimal "F", to indicate the end of the dialling number identifier. A fourth, fixed length, data block 74, consisting of one byte, is reserved for storing data relating to the type of dialling number stored in the record. A fifth, variable length, data block 76 is reserved for storage of message data, coded in the GSM extended BCD coding number set representing the dialling number. The length of the data block 76 corresponds with the amount of digits in the dialling number. A final data block 78, consisting of one nibble having each bit set to "one", is an end marker indicating the end of the record.

Figure 9 illustrates the same ADN data as was illustrated in Figure 5, coded according to the compressed data coding format. The first byte of each ADN data item, indicated as "XY", "WZ" and "UW" in each respective case, represents the new data created in data block 68. The remainder of each data item is

the restructured character data relating to the dialling number identifier, the type of number identifier, and the dialling number itself. As can be seen, unnecessary padding data is eliminated in the compressed data coding format. The only hexadecimal "F"s present are those used either for coding the alphabetical characters or are those used as end of data block markers. It will be apparent from Figure 9, when compared with Figure 5, that the data items when in the compressed data coding format occupy significantly less memory space than when in the standardised coding format.

The SIM operating system, implemented by the SIM processor 36, performs conversion between the compressed data coding format and the standardised data coding format when writing data to the SIM memory 38 and when retrieving data from the SIM memory 38. This ensures that the data items communicated via the interface 58 to or from the mobile station 8 are presented in the standardised data coding format, as required by the GSM standard.

If all data items occupied the allocated space in the fixed-length coding format, no discernable data compaction would be obtained by implementing the data coding format conversion method of the present invention. However, in practice since the

standardised format is defined so that the SIM is capable of accommodating relatively long dialling numbers, the majority of dialling numbers, and often also the dialling number identifiers, are shorter than the maximum length provided for. A significant amount of data compaction can therefore be achieved.

Referring now to Figure 10, in order to access an ADN data record, the mobile station processor 26 generates a "SELECT FILE" command selecting the ADN list file, which is received by the SIM processor 36 at step 80. Next, the processor 26 generates a "READ RECORD" command, received by the SIM processor 36 at step 82, specifying that record number n in the data file is to be read. These commands are specified in GSM technical specification 11.11. A conventional SIM card would respond by reading record n in the linear fixed file and transparently transmitting the record contents to the processor 26.

According to this embodiment of the present invention, the SIM processor, controlled by its operating system, first accesses the directory list 62 to identify the address of record n in the record space 64, step 84, and then reads the data beginning from that address in the record space 64, step 86, the length of the record being indicated by the length data stored in the first block 68 of the record.

The SIM processor 36 then decompresses the record contents by converting from the compressed data coding format to the standardised data coding format, adding the padding data where required to produce a data item of a fixed length, step 88. This is then transmitted across the interface 58 to the mobile station processor 26, step 90. The mobile station processor 26 then copies this data item to its associated memory 28, where it is stored temporarily for retrieval whilst the mobile station remains switched on.

Reference is now made to Figure 11. When the mobile station processor 26 wishes to write an ADN data item to the SIM 34, it generates a "SELECT FILE" command selecting the ADN list file, received by the SIM processor 36 at step 92. Next, the processor 26 sends the data item in the standardised data coding format across interface 58 to the SIM processor 36 with an "UPDATE RECORD n" command, received by the SIM processor 36 at step 94. The SIM processor then compresses the data by converting the data into the compressed data coding format, step 96, and stores the compressed data item in a newly created record at the end of the current records in the record space 64, step 98. The SIM operating system then makes a corresponding entry in the directory list 62, step 100.

When data records are consecutively entered in the record space 64, the records are contiguous. However, when a data record is deleted, or updated, the memory space previously occupied by that data record is filed with padding data (hexadecimal "F"s). In the case of a record being updated with new data, a new record is created and stored at the end of the current records, since it cannot be guaranteed that the record will be the same length once updated. Thus, when records are deleted or updated, the record space 64 will become fragmented. In order to overcome this, the card operating system periodically de-fragments the records in the record space 64, by reading a data record adjacent an empty space (filled with padding data) in the record space 64 into a buffer memory space and rewriting the record at least partially into the empty record space, contiguous with the adjacent record.

If de-fragmentation were implemented immediately after updating or deletion of a record, there would be a danger that the SIM could be switched off, in response to a command from the mobile station 8, during de-fragmentation, in which case it is possible that the data record contents could be lost. In this embodiment of the invention, the SIM operating system performs de-fragmentation in steps in response to a

command (which is intended to perform a different function) periodically sent to the SIM by the mobile station 8, such as a reset command.

A reset command is sent when the mobile station 8 is first switched on, and various initialisation steps are performed by the SIM processor 36 on receipt of a reset command. Since the ADN list update frequency is assumed to be relatively low, it is not necessary to de-fragment the entire ADN list at each reset.

Instead, de-fragmentation is performed gradually and a limited number of records, for example, 2 or 3, are de-fragmented per reset command. That is to say, 2 or 3 records are displaced in the record space 64 to occupy the space of a previously deleted or displaced record each time the SIM is reset. By this method, any delays experienced by the mobile station user, caused by de-fragmentation of the ADN list before the SIM is initialised, can be reduced.

The SIM includes a counter data record, incremented at each reset command, which indicates the present record number up to which de-fragmentation has been completed. The SIM processor 36 reads the volume of this counter data record at each reset command to determine which records are next to be de-fragmented. Thus, for a heavily fragmented record space 64, a

large block of available memory space is created as the records are gradually compacted together by de-fragmentation. Once de-fragmentation is completed, for all current records the SIM operating system resets the counter value and further de-fragmentation of the ADN list, if required, begins afresh at the first record in the record space when the SIM is again reset.

Other Embodiments

The data described has thus far been ADN data. However, it will be appreciated that the present invention can be applied to any other types of data required to be transmitted across the mobile station/removable data store interface according to the relevant standard in non-optimum data coding formats.

In the GSM standard, other data is transmitted between the mobile station and the SIM in a fixed length coding format similar to that of the ADN data, for which the present invention is therefore similarly applicable. Such other data includes fixed dialling number (FDN) data, mobile subscriber directory number (MSISDN) data, extension record data, etc.

Furthermore, although in the above embodiment a compression/decompression method implemented by stripping padding data from, and replacing padding

data in, data items is used, alternative, or additional, data coding format conversion methods are envisaged. Apart from the wasted memory space associated with padding data, many dialling numbers contain frequently repeated dialling codes. For example, the dialling code for mobile stations subscribing to a particular mobile communications network may have a dialling code of "0973". Replacing this code with a token code of shorter length could be implemented by the SIM operating system before storage of the dialling number in the SIM memory, with replacement of the code in its full length being implemented when the dialling number is retrieved from the SIM memory by the SIM operating system.

It is to be noted that the data format conversion need not necessarily be performed in the SIM. For example, a mobile station can be implemented which transmits (or receives) data items across the SIM/mobile station interface both in a standardised data coding format (such that the mobile station remains compatible with conventional SIMs, and therefore conforms to a standard), and in a compressed data coding format, such that a SIM in accordance with the present invention can store the data items received in the compressed data coding format, and disregard the standardised data coding format items.

Although the above description has related to a SIM used in a GSM-compatible mobile station, it should be appreciated that the present invention is applicable to equivalent forms of removable data store, such as smart cards, used in any other mobile communication system. References to GSM include other standards for which at least some features, in particular with regard to the mobile station/SIM interface, are set by the GSM technical specifications, such as the PCN standard and the DCS 1800 standard.

Furthermore, the present invention is not limited to use in mobile communications systems. The invention could be implemented in other forms of smart card, such as those used in electronic banking and other data storage applications.

Other variations, improvements and modifications are also envisaged to fall within the scope of the present invention.

CLAIMS:

1. A removable data store for a user station used in a mobile communications system, said store comprising a memory for storing data items communicated via an interface between said store and said user station, the data items being communicated via said interface in a standardised data coding format and said data items being stored in said memory in a different data coding format.

2. A data store according to claim 1, further comprising data coding format converting means operating between said interface and said memory.

3. A data store according to claim 2, wherein said data coding format converting means performs data compaction.

4. A data store according to claim 1, 2 or 3, wherein said standardised data coding format is a fixed length coding format and said different data coding format is a variable length coding format.

5. A data store according to claim 4, wherein said data items comprise a variable amount of non-

padding character data.

6. A data store according to claim 5, wherein said data items when in the variable length coding format have lengths varying in steps of one character.

7. A data store according to claim 5 or 6, wherein said character data comprises data representing alphanumeric characters.

8. A data store according to any of claims 5 to 7, wherein said character data comprises data representing a dialling number and/or a dialling number identifier.

9. A data store according to any of claims 5 to 8, wherein said character data represents information input by the user of the mobile station for subsequent retrieval from the data store, or transmission by the data store.

10. A data store according to any preceding claim, wherein said data items when in said standardised data coding format comprise padding data, and said data format converting means reduces the amount of padding data when converting to said

different data coding format.

11. A data store according to any preceding claim, wherein said data items are stored in data records in an allocated data file in said memory, said data file having an associated directory file storing an address for each said data record.

12. A data store according to claim 11, further comprising means for deleting a data record from said data file and reformatting means for (i) displacing another data record to occupy memory space previously occupied by the deleted record, and (ii) updating said directory file.

13. A data store according to claim 12, wherein said reformatting means is actuated in response to a command sent by the mobile station.

14. A data store according to any preceding claim which is a smart card.

15. A user station for a mobile communications system, comprising a data store according to any preceding claim.

16. A smart card comprising a memory for storing data items, input/output means for communicating said items to and/or from an external device in one data coding format, and data coding format converting means connected between said memory and said input/output means, operable such that said data items may be stored in said memory in a different data coding format.

17. A method of writing a data item to a data store for a user station used in a mobile communications system, comprising transmitting said data item to said data store in one data coding format, converting said data item to a second different data coding format, and storing said data item in said data store in said second data coding format.

18. A method according to claim 17, wherein said data coding format conversion is performed in the data store.

19. A method of transmitting a data item from a data store for a user station used in a mobile communications system, comprising converting the data item to a different coding format from that in which

it is stored, and transmitting the converted data item to said mobile station.

20. A method according to claim 17, 18 or 19, wherein data compaction and/or decompaction in performed during said conversion.

21. A method according to any of claims 17 to 20, wherein said transmitted data coding format is a fixed length coding format and said stored data coding format is a variable length coding format.

22. A method according to claim 20, wherein said data items comprise a variable amount of character data.

23. A method according to claim 22, wherein said data items when in the variable length coding format have lengths varying in steps of one character.

24. A method according to any of claims 17 to 23, comprising storing said data item when input by the user of the user station for subsequent retrieval.

25. A data store according to any of claims 17 to 24, said data format converting step comprising

changing an amount of padding data in said data item when converting to or from said different data coding format.

26. A method according to any of claims 17 to 25, further comprising deleting a data item from a data file in said memory and reformatting the data file by (i) displacing another data item to occupy memory space previously occupied by the deleted item, and (ii) updating a directory of said data file.

27. A method according to claim 26, wherein said reformatting is actuated in response to a command sent by the mobile station.

28. A subscriber identity module for use in a GSM-type mobile communications system, said module storing dialling numbers in variable length records.

29. A subscriber identity module according to claim 28, wherein said records are abbreviated dialling number (ADN) records.

30. A removable data store substantially as hereinbefore described, in particular with reference to the accompanying drawings.

31. A method of storing a data item, or retrieving a data item, substantially as hereinbefore described, in particular with reference to the accompany drawings.

The Patent Office

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Application No: GB 9619159.8 **Examiner:** Andrew Alton
Claims searched: 1-31 **Date of search:** 29 October 1996

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Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): G4A: AFGDC,AJR,AMG1 H4L: LECC

Int Cl (Ed.6): G06F: 3/06 G11C: 7/00 H03M: 7/30 H04Q: 7/32

Other: Online databases: COMPUTER, INSPEC, WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2270442 A	MOTOROLA - See Fig. 1 and abstract	1,14,15
X	EP 0614303 A1	ALCATEL - See Fig. 2 and abstract	1,14,15

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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